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Re-examination of the phase diagram of the high-T_c cuprate superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ studied by ARPES

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In high-T_c cuprate superconductors, superconductivity occurs upon hole doping into the CuO_2 plane. The electronic phase diagram of hole-doped high-T_c cuprate superconductors plotted as a function of temperature and carrier concentration has been reported as an empirical and universal phase diagram which is a dome-like shape centered at ~0.16 of hole concentration [1]. However, previous ARPES experiments suggest that its empirical phase diagram may not be universal and shifted toward overdoped region [2-4].

In this study, we have performed angle-resolved photoemission spectroscopy (ARPES) measurements systematically to directly investigate the electronic structure of the underdoped, optimally doped, and overdoped double-layer cuprates $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212). We have estimated the hole concentration of each sample from the Fermi-surface area and compared them quantitatively. Figure 1 shows the Fermi surface of the optimally doped Bi2212 with T_c = 92 K and we determine the Fermi momentum (red dots in Fig. 1) from the ARPES spectra.

In this poster presentation, we will show the results of hole concentration estimated from the Fermi surfaces in Bi2212 for each sample and the result is compared with the previous study to investigate the relationship between the hole concentration and T_c (phase diagram). As a result, the phase diagram in the present study is different from the previous one reported by Tallon *et al* [1]. Based on the present ARPES study, we will show the new phase diagram in Bi2212 and discuss the physical properties compared with the other studies.

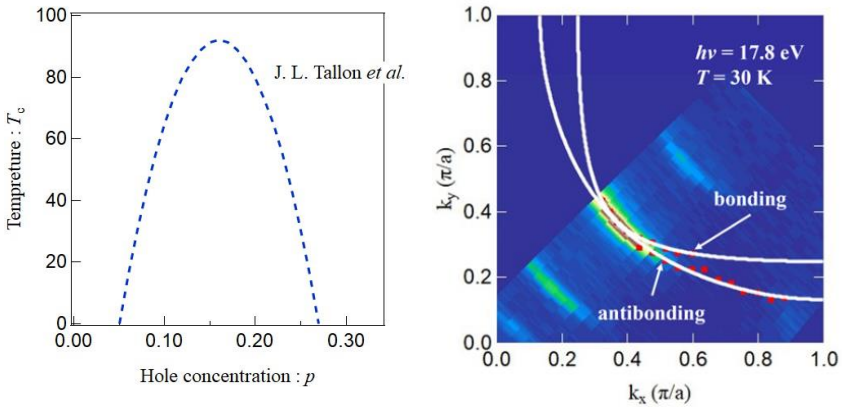

FIGURE 1. Schematic phase diagram of the double-layer cuprate Bi2212 (left) from Ref. [1]. Fermi surfaces of Bi2212 observed by ARPES (right). Red dots are the Fermi momentum estimated from momentum-distribution curves near the Fermi level. White curves are the Fermi surfaces obtained by tight-binding approximation and the bonding and antibonding bands are fitted by calculation.

REFERENCES

1. J. L. Tallon, C. Bernhard, H. Shaked, R. L. Hitterman and J. D. Jorgensen, *Phys. Rev. B* **51**, 12911 (1995).
2. I. K. Drozdov, I. Pletikosić, C.-K. Kim, K. Fujita, G. D. Gu, J. C. Séamus Davis, P. D. Johnson1, I. Božović and T. Valla, *Nat. Commun.* **9**, 5210 (2018).
3. R. Sodota, N. Kudo, M. Matsunami, and T. Takeuchi, *J. Phys. Soc. Jpn.* **88**, 064711 (2019).
4. H. Sakamoto, K. Ogawa, T. Kondo, S. Shin, M Matsunami, H. Ikuta, and T. Takeuchi, *J. Phys. Soc. Jpn.* **85**, 104710 (2016).